Please write clearly in block capitals.

Centre number [ ][ ][ ][ ][ ]   Candidate number [ ][ ][ ][ ]

Surname ______________________

Forename(s) ______________________

Candidate signature ______________________
I declare this is my own work.

GCSE PHYSICS

F

Foundation Tier   Paper 2

Time allowed: 1 hour 45 minutes

Materials
For this paper you must have:
- a ruler
- a scientific calculator
- a protractor
- the Physics Equations Sheet (enclosed).

Instructions
- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.
- In all calculations, show clearly how you work out your answer.

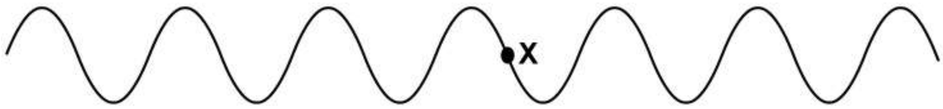
Information
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
9	
TOTAL	

Answer **all** questions in the spaces provided.

0 1 **Figure 1** shows a water wave.

Figure 1



0 1 . 1 What type of wave is a water wave?

[1 mark]

Tick (✓) **one** box.

Electromagnetic ☐

Longitudinal ☐

Transverse ☐

0 1 . 2 Which statement describes the movement of the water at point **X**?

[1 mark]

Tick (✓) **one** box.

The water at point **X** does **not** move. ☐

The water at point **X** moves to the left and right. ☐

The water at point **X** moves up and down. ☐

Do not write outside the box

0 1 . 3 The wave has a frequency of 2.0 hertz.

The wavelength is 0.032 metres.

Calculate the wave speed.

Use the equation:

wave speed = frequency × wavelength

Choose the unit from the box.

[3 marks]

m^2/s	**m/s**	**s^2**

Wave speed = ________________ Unit __________

0 1 . 4 What is transferred by all waves?

[1 mark]

Tick (✓) **one** box.

Energy ☐

Information ☐

Water ☐

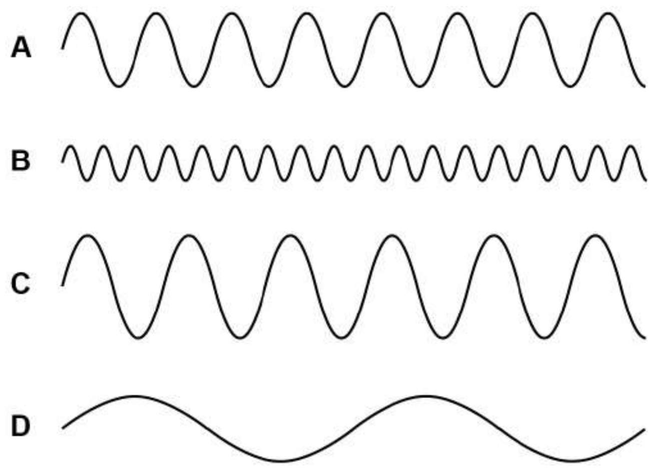
Question 1 continues on the next page

Figure 2 shows four water waves.

The waves are all drawn to the same scale.

The waves all travel at the same speed.

Figure 2



0 1 . 5 Which wave has the longest wavelength?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 6 Which wave has the highest frequency?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

8

Do not write outside the box

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

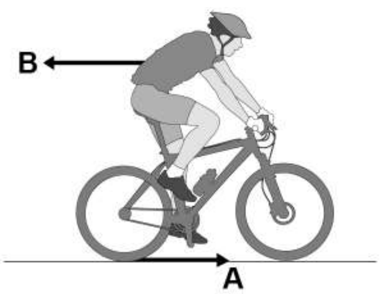
Do not write outside the box

0 2 **Figure 3** shows a cyclist on a bicycle.

The cyclist is moving at a constant velocity.

Arrows **A** and **B** represent the horizontal forces acting on the bicycle and cyclist.

Figure 3



0 2 . 1 What is force **A**?

[1 mark]

Tick (✓) **one** box.

Air resistance ☐

Friction ☐

Tension ☐

Upthrust ☐

0 2 . 2 What is force **B**?

[1 mark]

Tick (✓) **one** box.

Air resistance ☐

Magnetic ☐

Tension ☐

Upthrust ☐

0 2 . 3 What is the relationship between force **A** and force **B** when the cyclist travels at a constant velocity?

[1 mark]

Tick (✓) **one** box.

A = **B** ☐

A > **B** ☐

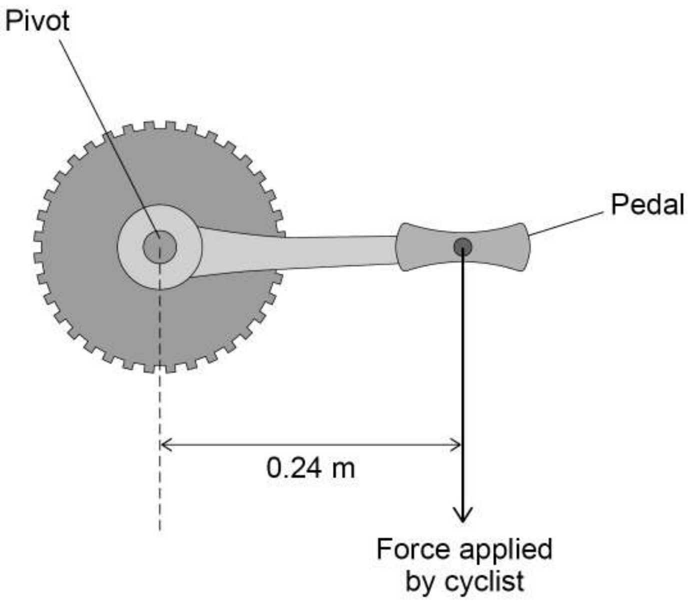
A < **B** ☐

Question 2 continues on the next page

0 2 . 4 The cyclist applies a force of 150 N to one of the bicycle pedals.

Figure 4 shows the distance between the force applied and the pivot.

Figure 4



Calculate the moment about the pivot caused by the force applied to the pedal in **Figure 4**.

Use the equation:

moment of a force = force × distance

[2 marks]

___

___

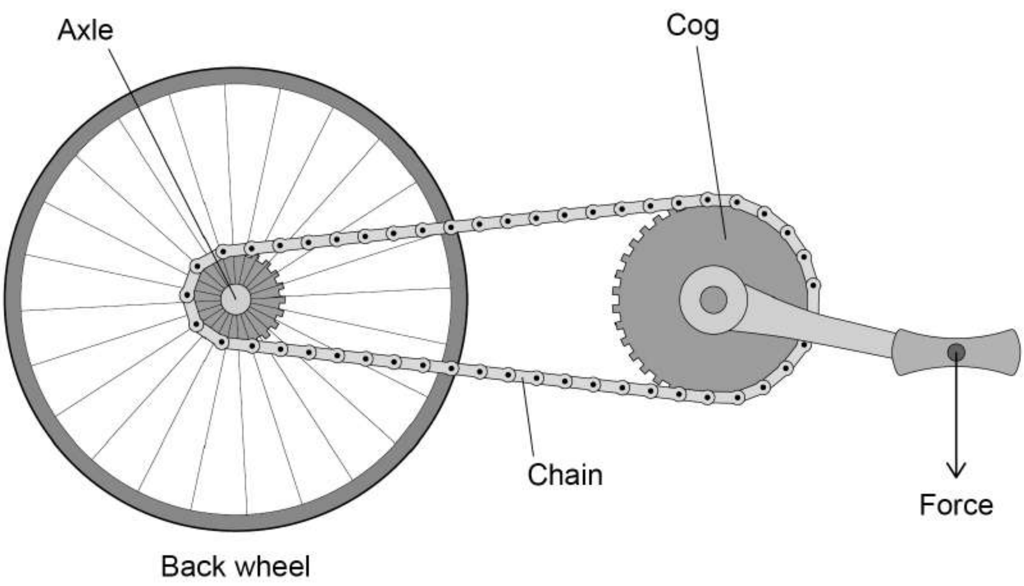
___

Moment = ____________________ N m

Do not write outside the box

0 2 . 5 **Figure 5** shows how the pedal is connected to the back wheel of the bicycle.

Figure 5



Complete the sentence.

Choose the answer from the box.

[1 mark]

axle	**chain**	**cog**

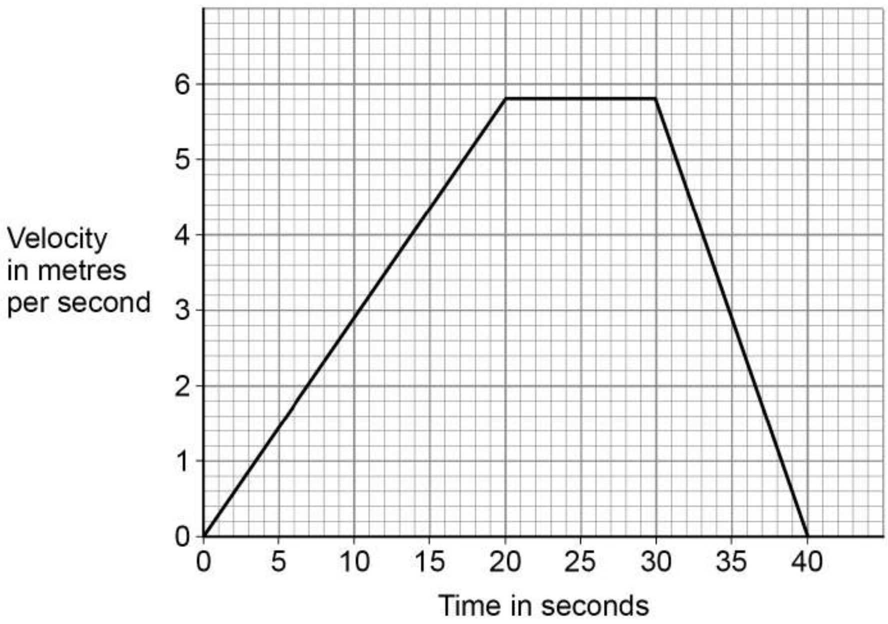
The force from the cyclist pushing down on the pedal is transmitted to the back wheel

by the ____________________ .

Question 2 continues on the next page

Figure 6 shows how the velocity of the cyclist changes during a journey.

Figure 6



0 2 . 6 What is the change in velocity of the cyclist in the first 20 seconds of the journey?

[1 mark]

Tick (✓) **one** box.

5.2 m/s ☐

5.4 m/s ☐

5.6 m/s ☐

5.8 m/s ☐

Do not write outside the box

0 2 . 7 Determine the acceleration of the cyclist during the first 20 seconds of the journey.

Use your answer from Question **02.6**

Use the equation:

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

[2 marks]

Acceleration of the cyclist = ____________________ m/s^2

0 2 . 8 Complete the sentence.

Choose the answer from the box.

[1 mark]

deceleration	**speed**	**velocity**

Between 30 and 40 seconds the cyclist moves with

a constant ____________________ .

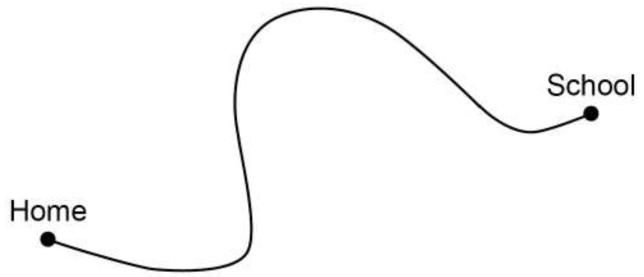
Question 2 continues on the next page

Do not write outside the box

0 2 . 9 The cyclist travels from home to school.

Figure 7 shows the route the cyclist followed.

Figure 7



Draw an arrow on **Figure 7** to show the displacement of the cyclist.

[1 mark]

11

0 3 There are different groups of waves in the electromagnetic spectrum.

0 3 . 1 **Figure 8** shows the position of three groups of the waves.

Figure 8

A	Microwaves	**B**	Visible light	**C**	**D**	Gamma rays

Which letter shows the position of infrared?

[1 mark]

Tick (✓) **one** box.

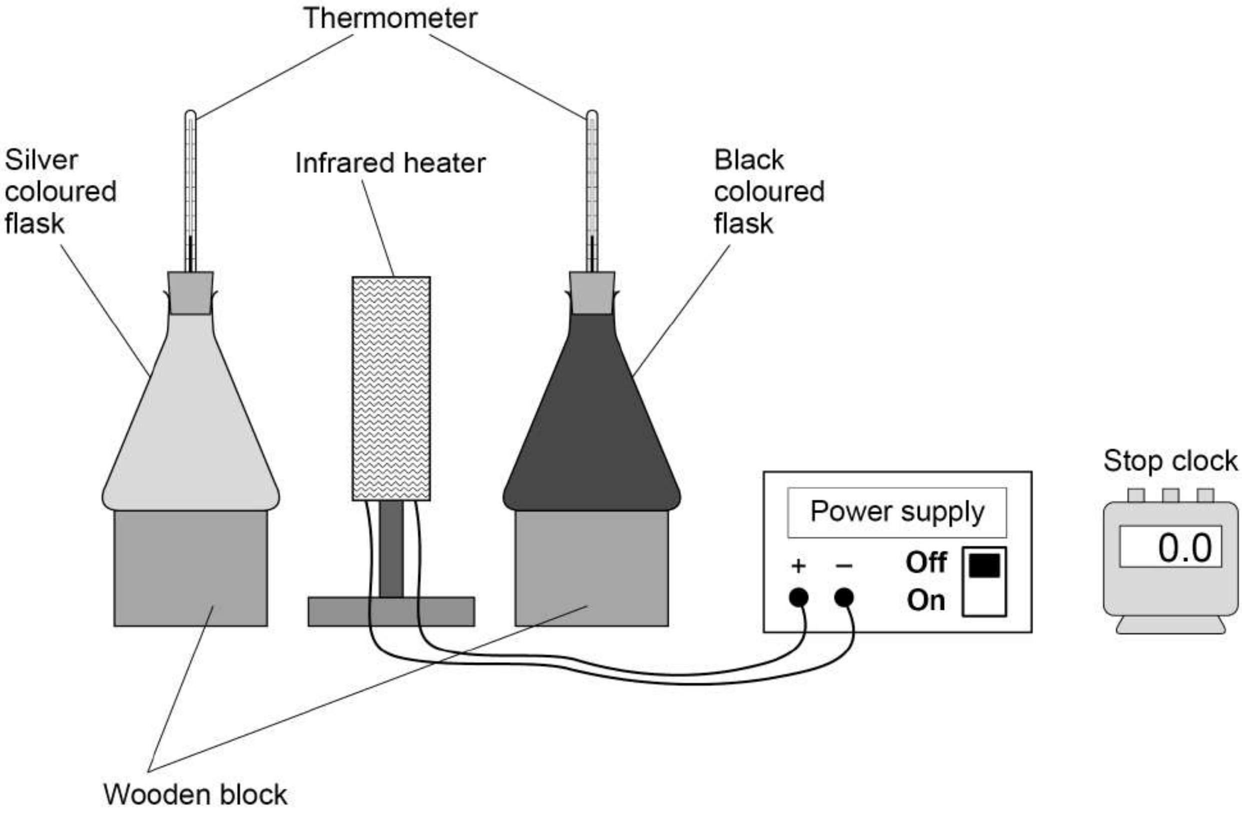
A ☐ **B** ☐ **C** ☐ **D** ☐

Question 3 continues on the next page

A student investigated how the colour of a surface affects the amount of infrared the surface absorbs.

Figure 9 shows the equipment used.

Figure 9



0 3 . 2 Complete the sentence.

Choose the answer from the box.

[1 mark]

a control	**the dependent**	**the independent**

In this investigation the distance between each flask and the infrared heater

is ______________________________ variable.

0 3 . 3 The student wrote the hypothesis:

'Surface colour of the flask affects the amount of infrared absorbed when the heater is switched on for five minutes.'

Describe how the equipment in **Figure 9** could be used to test this hypothesis.

[4 marks]

____

____

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Question 3 continues on the next page

Do not write outside the box

Table 1 shows the results.

Table 1

Colour of flask	**Temperature increase in °C**		
	Test 1	**Test 2**	**Test 3**
Black	19	17	27
Silver	10	12	11

0 3 . 4 Which **one** of the results for the black flask is anomalous?

[1 mark]

____

0 3 . 5 The anomalous result was caused by reading the thermometer incorrectly.

What should the student do with the anomalous result?

[1 mark]

____

____

0 3 . 6 Calculate the mean temperature increase for the silver flask.

[1 mark]

____

____

Mean temperature increase = ____________________ °C

0 3 . 7 What conclusion can be made from **Table 1?**

[1 mark]

Tick (✓) **one** box.

Both flasks absorbed the same amount of infrared during the five minutes. ☐

The black flask absorbed the most infrared during the five minutes. ☐

The silver flask absorbed the most infrared during the five minutes. ☐

10

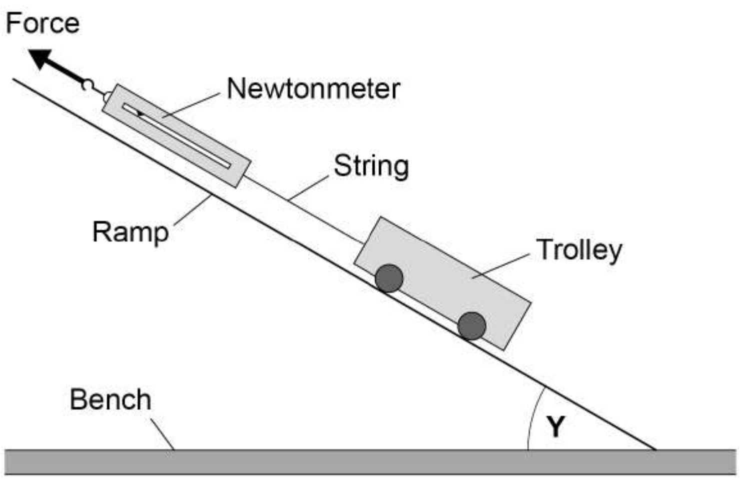
Turn over for the next question

Do not write outside the box

0 4 A student investigated how the angle of a ramp affects the force required to hold a trolley stationary on the ramp.

Figure 10 shows the equipment used.

Figure 10



0 4 . 1 Measure the angle **Y** in **Figure 10**

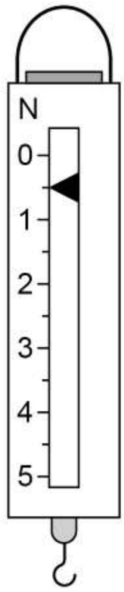
[1 mark]

Angle **Y** = ____________________ degrees

Do not write outside the box

Figure 11 shows the newtonmeter before the investigation started.

Figure 11



0 4 . 2 What type of error is shown on the newtonmeter in **Figure 11**?

[1 mark]

Tick (✓) **one** box.

Human error ☐

Random error ☐

Zero error ☐

0 4 . 3 How can this error be corrected after the measurements have been taken?

[1 mark]

Tick (✓) **one** box.

Add 0.5 N to each measurement ☐

Multiply each measurement by 0.5 N ☐

Subtract 0.5 N from each measurement ☐

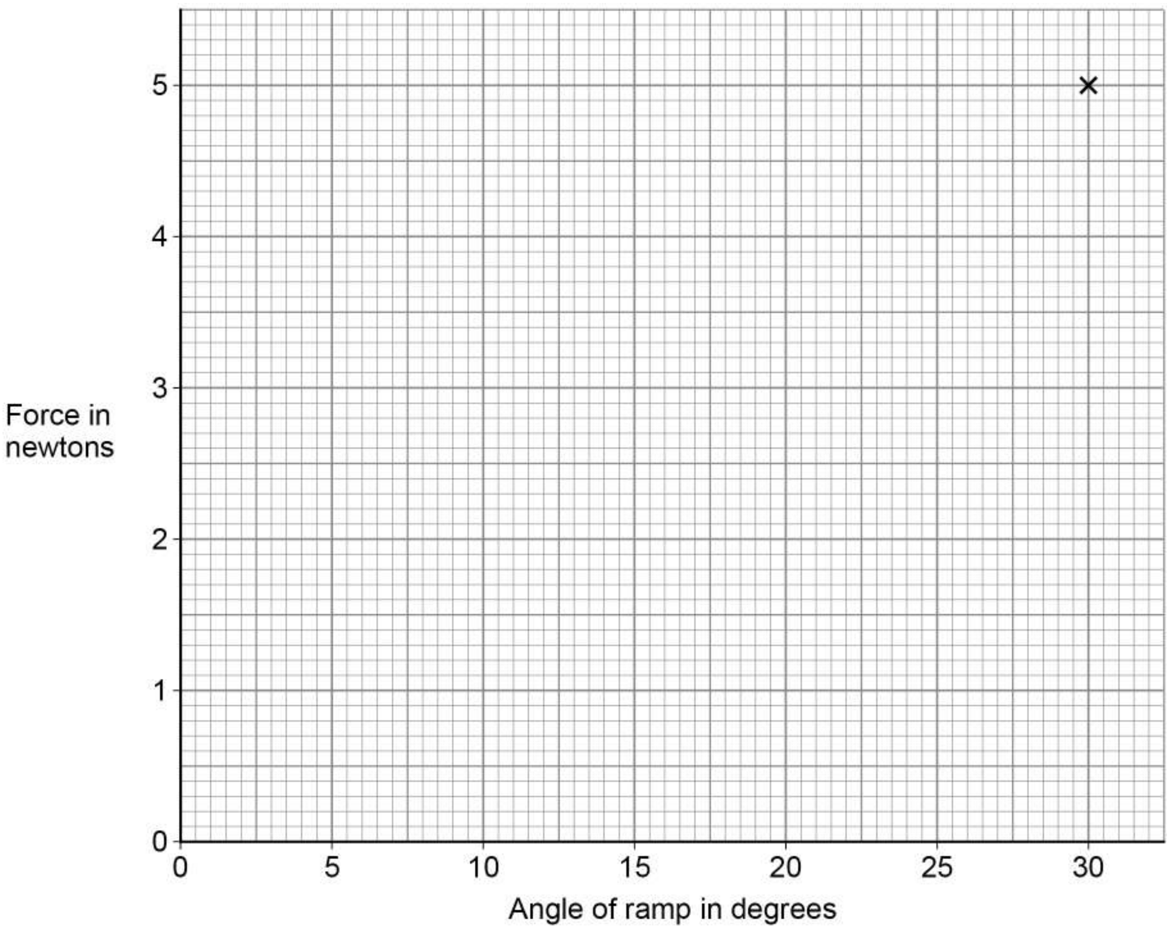
Table 2 shows the corrected results.

Table 2

Angle of ramp in degrees	Force in newtons
5	0.9
10	1.7
15	2.6
20	3.4
25	4.2
30	5.0

Figure 12 is an incomplete graph of the results

Figure 12



Do not write outside the box

0 4 . 4 Plot the missing results from **Table 2** on **Figure 12**.

[2 marks]

0 4 . 5 **Figure 13** shows a person in a wheelchair using two different ramps to enter a van.

Figure 13

The ramps are at different angles to the ground.

Explain **one** advantage of using the long ramp compared with using the short ramp.

[2 marks]

____

____

____

____

0 4 . 6 A force of 160 N is used to move the wheelchair up the long ramp.

The ramp is 2.5 m long.

Calculate the work done to move the wheelchair up the ramp.

Use the equation:

work done = force × distance

[2 marks]

____

____

____

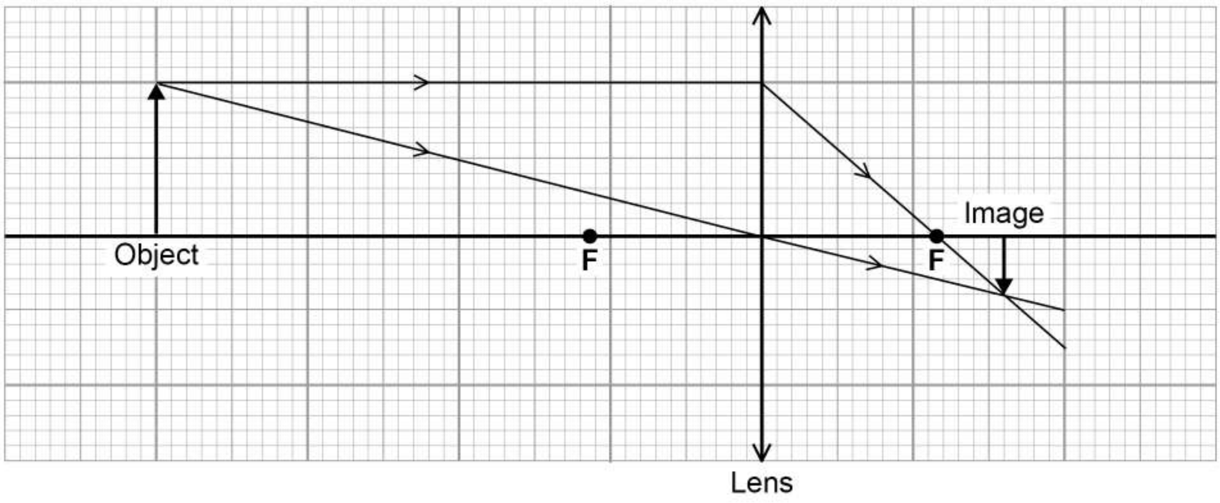
Work done = ____________________ J

9

Turn over ►

0 5 **Figure 14** shows how a lens forms an image of an object.

Figure 14



0 5 . 1 What type of lens is represented in **Figure 14**?

[1 mark]

Tick (✓) **one** box.

Concave ☐

Convex ☐

Diverging ☐

0 5 . 2 Measure the image height and the object height in **Figure 14**.

[1 mark]

Image height = ____________ cm

Object height = ____________ cm

Do not write outside the box

0 5 . 3 Calculate the magnification produced by the lens.

Use the equation:

$$\text{magnification} = \frac{\text{image height}}{\text{object height}}$$

[2 marks]

Magnification = ____________________

0 5 . 4 Which **two** words describe the image in **Figure 14**?

[2 marks]

Tick (✓) **two** boxes.

Enlarged ☐

Inverted ☐

Real ☐

Upright ☐

Virtual ☐

Question 5 continues on the next page

Do not write outside the box

0 5 . 5 The object was blue.

A student looked at the blue object through a green filter.

Complete the sentences.

Choose answers from the box.

[2 marks]

black	**blue**	**green**	**red**	**white**

Looking at the blue object through a green filter makes the object appear

__________________ .

This is because the green filter only transmits the light that is __________________ .

8

Do not write outside the box

Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

0 6 The Sun is the closest star to the Earth.

0 6 . 1 A 2.5 kg mass would have a weight of 750 N at the surface of the Sun.

Calculate the gravitational field strength at the surface of the Sun.

Use the equation:

$$\text{gravitational field strength} = \frac{\text{weight}}{\text{mass}}$$

[2 marks]

Gravitational field strength = ____________ N/kg

0 6 . 2 Gravity is a non-contact force.

Which of the following is also a non-contact force?

[1 mark]

Tick (✓) **one** box.

Air resistance ☐

Electrostatic ☐

Friction ☐

Tension ☐

0 6 . 3 All stars have a life cycle.

Figure 15 shows part of the life cycle of a star that becomes a black dwarf.

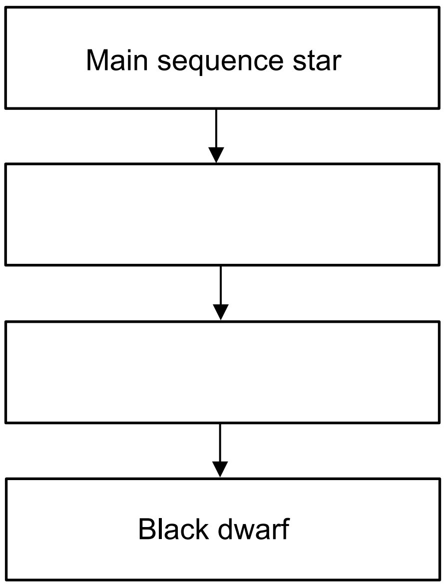
Complete **Figure 15**.

Choose answers from the box.

[2 marks]

Black hole		**Neutron star**
Red giant	**Supernova**	**White dwarf**

Figure 15



Question 6 continues on the next page

Table 3 gives the mass of three stars compared to the mass of the Sun.

Table 3

Star	Mass compared to the mass of the Sun
X	× 25.0
Y	× 15.0
Z	× 0.9

0 6 . 4 Which letter represents the star most likely to become a black dwarf?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

X ☐ **Y** ☐ **Z** ☐

Reason ____

____

____

0 6 . 5 In which stage of the life cycle of a star are elements heavier than iron produced?

[1 mark]

Tick (✓) **one** box.

Nebula ☐

Protostar ☐

Supernova ☐

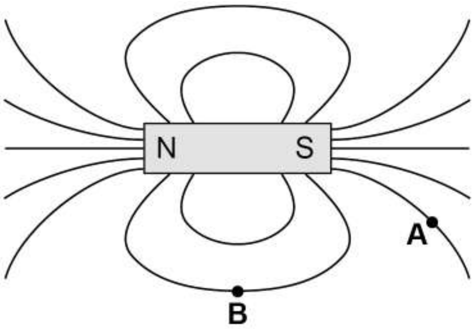
8

Turn over for the next question

Turn over ►

0 7 **Figure 16** shows the magnetic field pattern around a bar magnet.

Figure 16



0 7 . 1 Draw an arrow at point **A** and point **B** to show the direction of the magnetic field at each point.

[1 mark]

0 7 . 2 A bar magnet produces its own magnetic field.

Complete the sentence.

Choose the answer from the box.

[1 mark]

an electromagnet	**an induced magnet**	**a permanent magnet**

A bar magnet is an example of ____ .

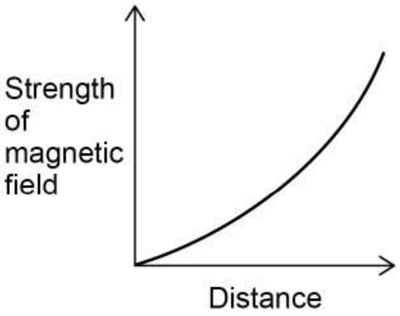
Do not write outside the box

0 7 . 3 Which graph shows how the strength of the magnetic field varies with distance from the bar magnet?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.



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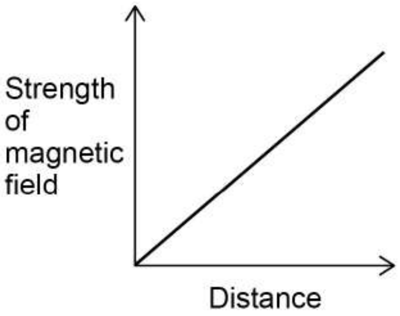

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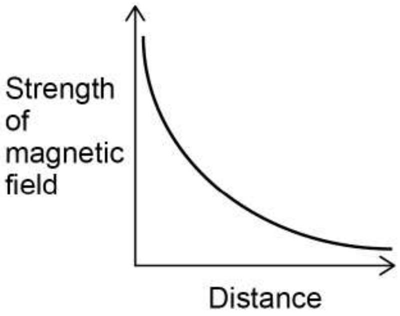


☐

Reason ____

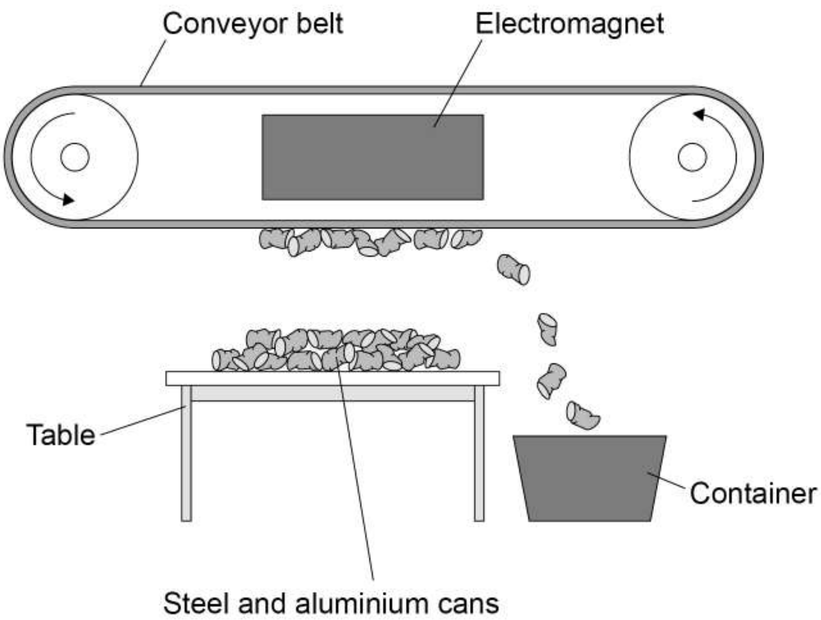
____

Question 7 continues on the next page

Do not write outside the box

Figure 17 shows an electromagnet being used to separate aluminium cans from steel cans.

Figure 17



0 7 . 4 Explain how the electromagnet and conveyor belt are used to separate the steel cans from the aluminium cans.

[2 marks]

Do not write outside the box

0 7 . 5 At the top of the table the strength of the magnetic field is only just enough to pick the cans up.

Describe **two** ways to increase the strength of magnetic field at the top of the table.

[2 marks]

1 ____

____

2 ____

____

0 7 . 6 Write down the equation which links distance travelled (*s*), speed (*v*) and time (*t*).

[1 mark]

____

0 7 . 7 The conveyor belt moves a can at a speed of 1.7 m/s.

Calculate the time taken to move the can 3.3 m at this speed.

Give your answer to 2 significant figures.

[4 marks]

____

____

____

____

____

Time taken (2 significant figures) = ______________ s

13

Turn over for the next question

There are no questions printed on this page

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ANSWER IN THE SPACES PROVIDED

0 8 The thinking distance and braking distance for a car vary with the speed of the car.

0 8 . 1 Explain the effect of **two** other factors on the **braking** distance of a car.

Do **not** refer to speed in your answer.

[4 marks]

Question 8 continues on the next page

0 8 . 2 Which equation links acceleration (a), mass (m) and resultant force (F).

[1 mark]

Tick (✓) **one** box.

resultant force = mass × acceleration ☐

resultant force = mass × acceleration^2 ☐

resultant force = $\dfrac{\text{mass}}{\text{acceleration}^2}$ ☐

resultant force = $\dfrac{\text{mass}}{\text{acceleration}}$ ☐

0 8 . 3 The mean braking force on a car is 7200 N.

The car has a mass of 1600 kg.

Calculate the deceleration of the car.

[3 marks]

____

____

____

____

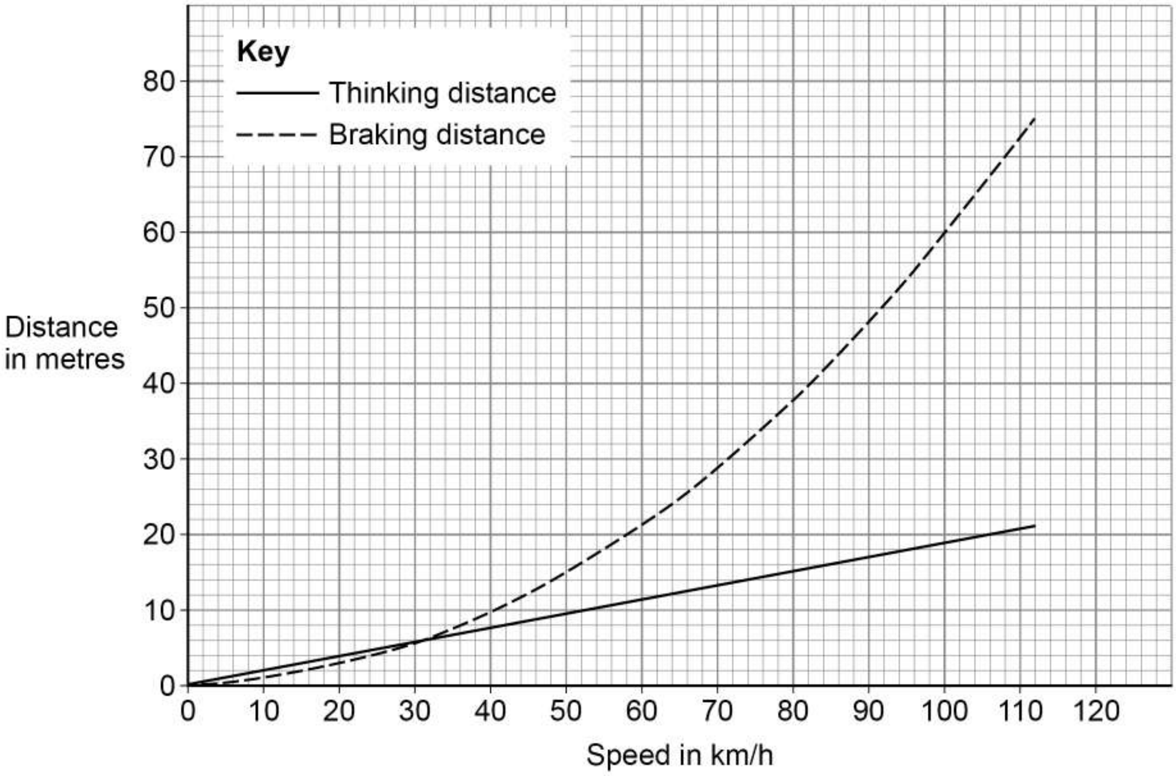
____

Deceleration = ____________ m/s^2

Do not write outside the box

0 8 . 4 **Figure 18** shows how the thinking distance and braking distance for a car vary with the speed of the car.

Figure 18



Determine the stopping distance when the car is travelling at 80 km/h.

[2 marks]

____

____

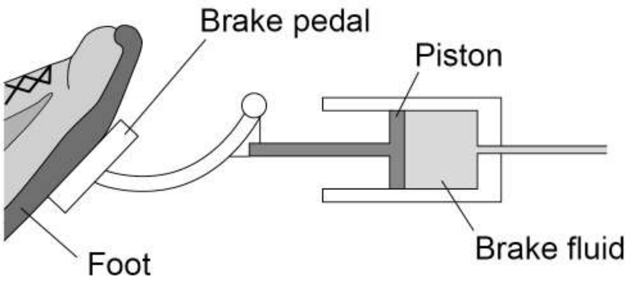
____

Stopping distance = ________________ m

Question 8 continues on the next page

Figure 19 shows part of the braking system for a car.

Figure 19



0 8 . 5 Which equation links area of a surface (A), the force normal to that surface (F) and pressure (p)?

[1 mark]

Tick (✓) **one** box.

$p = F \times A$ ☐

$p = F \times A^2$ ☐

$p = \frac{F}{A}$ ☐

$p = \frac{A}{F}$ ☐

Do not write outside the box

0 8 . 6 When the brake pedal is pressed, a force of 60 N is applied to the piston.

The pressure in the brake fluid is 120 000 Pa.

Calculate the surface area of the piston.

Give your answer in standard form.

Give the unit.

[5 marks]

Surface area (in standard form) = ____________________ Unit __________

16

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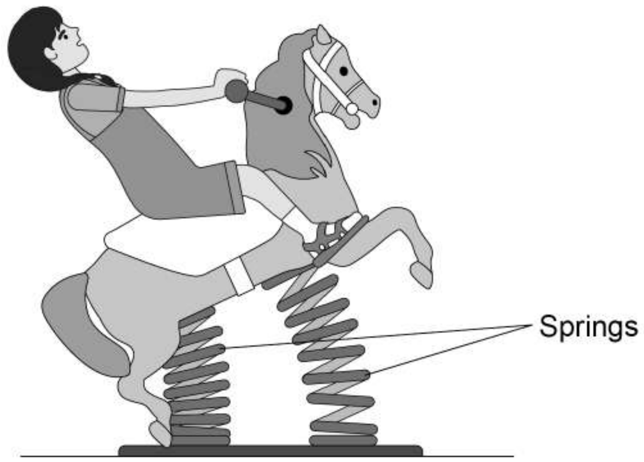
ANSWER IN THE SPACES PROVIDED

Do not write outside the box

0 9 **Figure 20** shows a child on a playground toy.

Figure 20



0 9 . 1 The springs have been elastically deformed.

Explain what is meant by 'elastically deformed'.

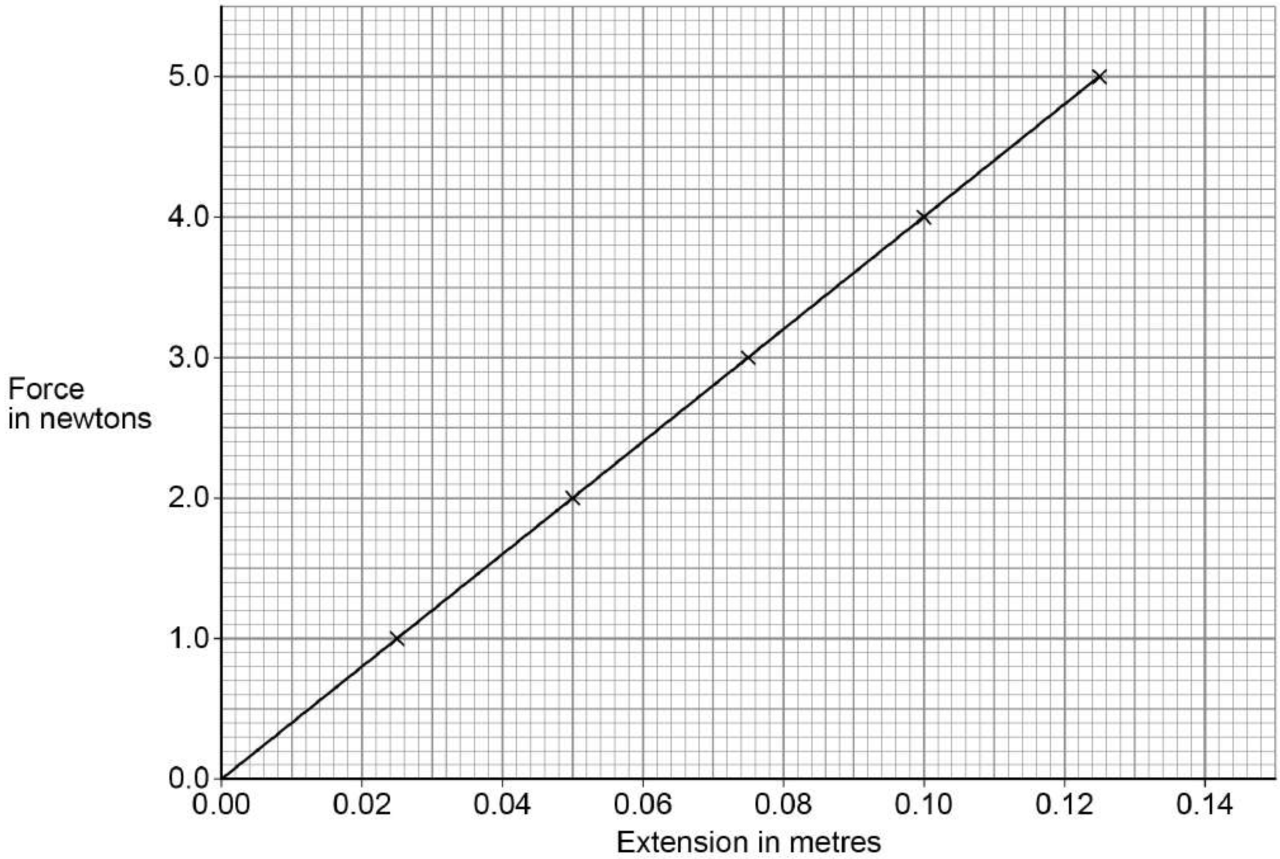
[2 marks]

Question 9 continues on the next page

A student investigated the relationship between the force applied to a spring and the extension of the spring.

Figure 21 shows the results.

Figure 21



0 9 . 2 Describe a method the student could use to obtain the results given in **Figure 21**.

You should include a risk assessment for **one** hazard in the investigation.

Your answer may include a diagram.

[6 marks]

Question 9 continues on the next page

Do not write outside the box

0 9 . 3 Which equation links extension (e), force (F) and spring constant (k).

[1 mark]

Tick (✓) **one** box.

force = spring constant × (extension)^2 ☐

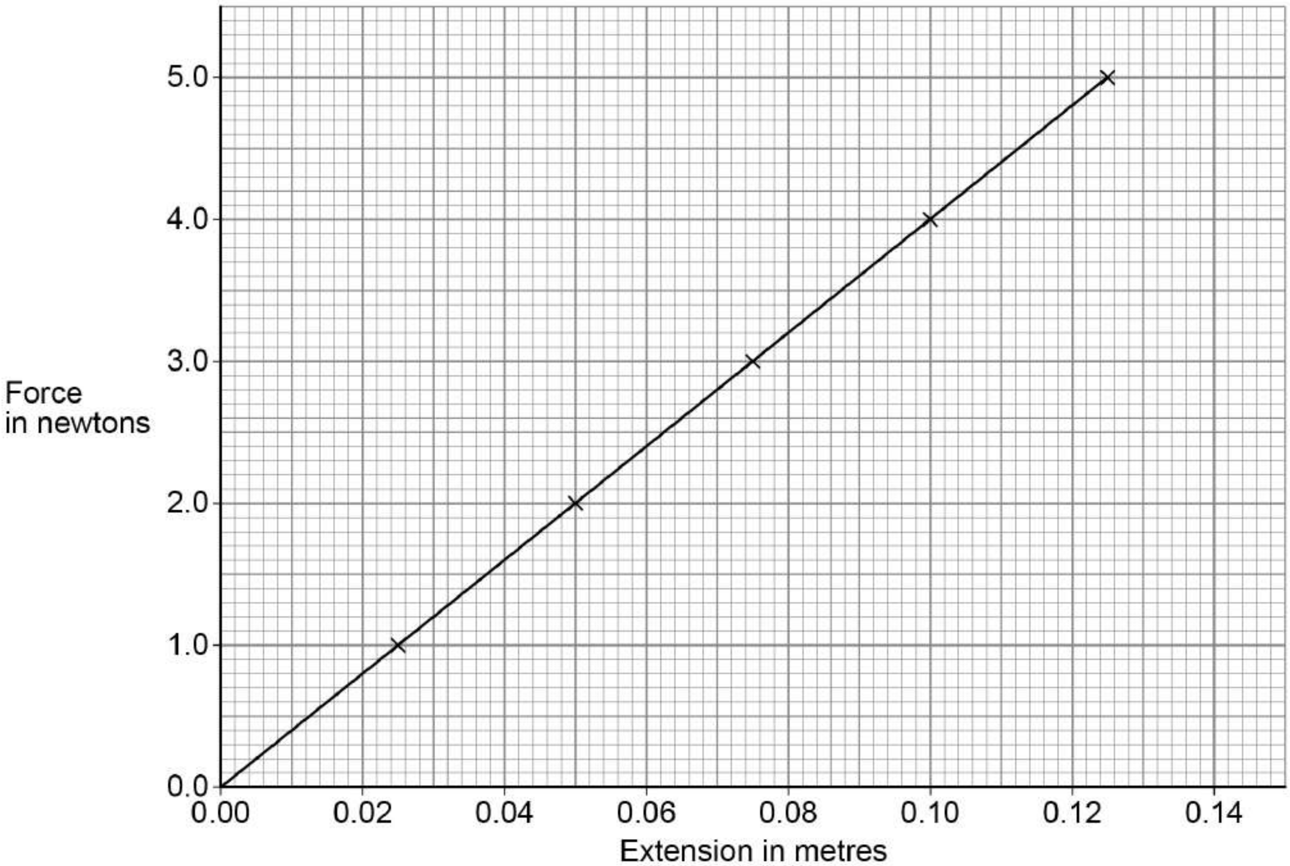
force = spring constant × extension ☐

force = $\frac{\text{extension}}{\text{spring constant}}$ ☐

force = $\frac{\text{spring constant}}{\text{extension}}$ ☐

Figure 21 is repeated below.

Figure 21



Do not write outside the box

0 9 . 4 Determine the spring constant of the spring.

Use **Figure 21**.

[3 marks]

Spring constant = ________________ N/m

0 9 . 5 The student concluded:

'The extension of the spring is directly proportional to the force applied to the spring.'

Describe how **Figure 21** supports the student's conclusion.

[2 marks]

Question 9 continues on the next page

Do not write outside the box

0 9 . 6 The student repeated the investigation using a different spring with a spring constant of 13 N/m.

Calculate the elastic potential energy of the spring when the extension of the spring was 20 cm.

Use the Physics Equations Sheet.

[3 marks]

Elastic potential energy = ______________ J

17

END OF QUESTIONS

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ANSWER IN THE SPACES PROVIDED

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ANSWER IN THE SPACES PROVIDED